CLAIMS

1. A modified polymer particle improved in the acid·alkali durability, obtained by treating a polymer particle containing an ester bond with an acid or alkali hydrous solution to partially hydrolyze the ester bond and isolate a carboxyl group and capping the free carboxyl group through amidation.

2. The modified polymer particle improved in the acid·alkali durability as claimed in Claim 1, wherein the ester bond having been hydrolyzed is an ester bond readily coming into contact with liquid.

3. The modified polymer particle improved in the acid·alkali durability as claimed in Claim 1, wherein the amine used for the amidation is an amine represented by formula (1):

$$NHR^1R^2 \qquad (1)$$

(wherein R^1 and R^2 each independently represents a hydrogen atom, an alkyl group having a carbon number of 18 or less, which may be branched or may be substituted by a halogen, or a phenyl group).

4. The modified polymer particle improved in the acid·alkali durability as claimed in Claim 3, wherein the amine used for the amidation is an amine represented by formula (2):

NH_2R^3 (2)

(wherein R^3 represents a hydrogen atom, an alkyl group having a carbon number of 18 or less, which may be branched or may be substituted by a halogen, or a phenyl group).

5. A modified polymer particle improved in the acid·alkali durability, wherein when the polymer particle is packed in a column having an inner diameter of 4.6 mm and a length of 150 mm and the alkali durability is evaluated using the column by the following method, the increase percentage of the pyridine retentivity after passing an alkali eluent is 50% or less:

Evaluation Method:

(1) an eluent of acetonitrile/aqueous 0.1% phosphoric acid solution = 30/70 is passed at a flow rate of 0.3 ml/min for 30 minutes, the column temperature is set to 40°C, and the pyridine retentivity is measured by using an eluent of acetonitrile/water = 30/70 at a flow rate of 0.5 ml/min,

(2) an alkali eluent of acetonitrile/aqueous 0.01 mol sodium hydroxide solution = 50/50 is passed through the same column at a flow rate of 0.5 ml/min for 4 hours at a column temperature of 40°C, then an eluent of acetonitrile/ aqueous 0.1% phosphoric acid solution = 30/70 is passed at a flow rate of 0.3 ml/min for 30 minutes, the column temperature is set to 40°C, and the pyridine retentivity is measured by using an eluent of

acetonitrile/water = 30/70 at a flow rate of 0.5 ml/min, and

(3) the pyridine retentivity of (2) is compared with the pyridine retentivity of (1).

6. The modified polymer particle improved in the acid·alkali durability as claimed in any one of Claims 1 to 5, wherein the average particle size of the polymer particle is from 1 to 50 μm.

7. A polymer-base packing material for chromatography, using a modified polymer particle improved in the acid·alkali durability, the polymer particle being obtained by treating a polymer particle containing an ester bond with an acid or alkali hydrous solution to partially hydrolyze the ester bond and isolate a carboxyl group and then capping the free carboxyl group through amidation.

8. The polymer-base packing material for chromatography as claimed in Claim 7, wherein the ester bond having been hydrolyzed is an ester bond readily coming into contact with liquid.

9. The polymer-base packing material for chromatography as claimed in Claim 7, wherein the amine used for the amidation is an amine represented by formula (1):

$$NHR^1R^2 \qquad (1)$$

(wherein R^1 and R^2 each independently represents a hydrogen atom, an alkyl group having a carbon number of 18 or less, which may be branched or may be substituted by a halogen, or a phenyl group).

10. The polymer-base packing material for chromatography as claimed in Claim 9, wherein the amine used for the amidation is an amine represented by formula (2):

$$NH_2R^3 \qquad (2)$$

(wherein R^3 represents a hydrogen atom, an alkyl group having a carbon number of 18 or less, which may be branched or may be substituted by a halogen, or a phenyl group).

11. A polymer-base packing material for chromatography, using a modified polymer particle improved in the acid·alkali durability such that when the polymer particle is packed in a column having an inner diameter of 4.6 mm and a length of 150 mm and the alkali durability is evaluated using the column by the following method, the increase percentage of the pyridine retentivity after passing an alkali eluent is 50% or less:

Evaluation Method:

(1) an eluent of acetonitrile/aqueous 0.1% phosphoric acid solution = 30/70 is passed at a flow rate of 0.3 ml/min for 30 minutes, the column temperature is set to 40°C, and the pyridine retentivity is measured by using an eluent of acetonitrile/water = 30/70 at a flow

rate of 0.5 ml/min,

(2) an alkali eluent of acetonitrile/aqueous 0.01 mol sodium hydroxide solution = 50/50 is passed through the same column at a flow rate of 0.5 ml/min for 4 hours at a column temperature of 40°C, then an eluent of acetonitrile/ aqueous 0.1% phosphoric acid solution = 30/70 is passed at a flow rate of 0.3 ml/min for 30 minutes, the column temperature is set to 40°C, and the pyridine retentivity is measured by using an eluent of acetonitrile/water = 30/70 at a flow rate of 0.5 ml/min, and

(3) the pyridine retentivity of (2) is compared with the pyridine retentivity of (1).

12. The polymer-base packing material for chromatography as claimed in any one of Claims 7 to 11, wherein the average particle size of the polymer particle is from 1 to 50 μm.

13. A method for producing a modified polymer particle improved in the acid·alkali durability, comprising treating a polymer particle containing an ester bond with an acid or alkali hydrous solution to partially hydrolyze the ester bond and isolate a carboxyl group and then capping the free carboxyl group through amidation.

14. The method for producing a modified polymer particle improved in the acid·alkali durability as claimed in Claim

13, wherein the ester bond having been hydrolyzed is an ester bond readily coming into contact with liquid.

15. The method for producing a modified polymer particle improved in the acid·alkali durability as claimed in Claim 13, wherein the amine used for the amidation is an amine represented by formula (1):

$$NHR^1R^2 \qquad (1)$$

(wherein R^1 and R^2 each independently represents a hydrogen atom, an alkyl group having a carbon number of 18 or less, which may be branched or may be substituted by a halogen, or a phenyl group).

16. The method for producing a modified polymer particle improved in the acid·alkali durability as claimed in Claim 15, wherein the amine used for the amidation is an amine represented by formula (2):

$$NH_2R^3 \qquad (2)$$

(wherein R^3 represents a hydrogen atom, an alkyl group having a carbon number of 18 or less, which may be branched or may be substituted by a halogen, or a phenyl group).

17. The method for producing a modified polymer particle improved in the acid·alkali durability as claimed in any one of Claims 13 to 16, wherein when the polymer particle is packed in a column having an inner diameter of 4.6 mm and a length of 150 mm and the alkali durability is

evaluated using the column by the following method, the increase percentage of the pyridine retentivity after passing an alkali eluent is 50% or less:

Evaluation Method:

(1) an eluent of acetonitrile/aqueous 0.1% phosphoric acid solution = 30/70 is passed at a flow rate of 0.3 ml/min for 30 minutes, the column temperature is set to 40°C, and the pyridine retentivity is measured by using an eluent of acetonitrile/water = 30/70 at a flow rate of 0.5 ml/min,

(2) an alkali eluent of acetonitrile/aqueous 0.01 mol sodium hydroxide solution = 50/50 is passed through the same column at a flow rate of 0.5 ml/min for 4 hours at a column temperature of 40°C, then an eluent of acetonitrile/ aqueous 0.1% phosphoric acid solution = 30/70 is passed at a flow rate of 0.3 ml/min for 30 minutes, the column temperature is set to 40°C, and the pyridine retentivity is measured by using an eluent of acetonitrile/water = 30/70 at a flow rate of 0.5 ml/min, and

(3) the pyridine retentivity of (2) is compared with the pyridine retentivity of (1).

18. The method for producing a modified polymer particle improved in the acid·alkali durability as claimed in any one of Claims 13 to 16, wherein the average particle size of the polymer particle is from 1 to 50 μm.

19. A method for producing a polymer-base packing material for chromatography, comprising producing the polymer-base packing material for chromatography described in any one of Claims 6 to 12 by performing one or both of the hydrolysis treatment with an acid or alkali hydrous solution and the capping treatment through amidation, in the state of the polymer-base packing material being packed in the column.

20. A chromatography column using the polymer-base packing material for chromatography improved in the acid·alkali durability described in any one of Claims 6 to 12.